Precautions in Handling Tissues, Fluids, and Other Contaminated Materials from Patients with Documented or Suspected Creutzfeldt-Jakob Disease

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Creutzfeldt-Jakob disease (CJD) is a fatal dementing disorder of humans that has been transmitted to laboratory animals [13, 20, 28]. It affects from 0.25 to more than 1 person per 10^6 population per year in various populations worldwide [4, 15, 21]. It has been estimated that the incubation period can be from months to decades, but once symptoms develop, the disorder is usually fatal within one year [4, 14, 29]. A small percentage of patients do survive for a longer time and most of their brain extracts are still able to transmit the disorder to laboratory animals [9]. There is no specific therapy available and there are no vaccines. The disorder is caused by a slow infectious pathogen with unusual properties that appear to distinguish it from conventional viruses and viroids [3, 13, 23, 24]. Epidemiological studies have not substantiated the hypothesis that the consumption of scrapie-infected sheep meat might result in CJD [4, 17], and currently there is no convincing evidence for the natural transmission of CJD from one person to another [4, 21]. There is abundant evidence, however, for the transmission of the similar pathogen causing kuru among New Guineans after handling and eating kuru-infected brain during ritualistic cannibalism [13]. The disappearance of kuru has followed a pattern indicating no communicability without opening of the corpses; i.e., no transplacental, neonatal, perinatal, or other form of person-to-person transmission [13, 16].

CJD also does not appear to be a spontaneously contagious disease, but there are several instances of iatrogenic transmission. One patient with CJD was the recipient of a corneal transplant from a donor with CJD [12]. Two additional patients with CJD developed disease after implantation of depth electroencephalographic electrodes that had previously been used in a patient with CJD and sterilized by usual conventional techniques [2]. Recently several young patients have apparently developed CJD after prolonged therapy with human growth hormone derived from pools of autopsy pituitary glands. Neither domestic nor patient close contact and associations, however, are associated with a higher risk of developing CJD than is found in the general population [1, 4]. It is of note that there are no documented cases of CJD among general pathologists, neuropathologists, neurologists, laboratory technicians, autopsy technicians, morticians, or virologists [7, 14], and it is interesting that there are no documented examples of CJD-like disease among primates with prolonged exposure to experimental animals to which CJD had been transmitted [7].

It is possible to transmit CJD to nonhuman primates and small laboratory animals by intracerebral, subcutaneous, intraperitoneal, intramuscular, and intravenous inoculation [14] and by ocular transplantation [18]. Subcutaneous and intramuscular routes of inoculation are said to be less efficient than the intracerebral route in producing disease, but still were able to do so [4, 21].

It is important to note that although central nervous system tissues, including optic tissues and cerebrospinal fluid, have the highest infectious titers, other tissues with a lower titer of infectivity are still transmissible, including liver, lung, lymph node, kidney, and leukocytes [14, 19]. Blood has been infectious in both human and experimental CJD, and urine has also re-

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cently been found to be infectious in humans [19a, 27a]; other secretory or excretory products such as saliva, external secretions, and stool have not been found to contain the pathogen. The rare conjugal cases have occurred nearly simultaneously in both spouses, indicating a common source of infection rather than cross-contamination. Clearly, patients with CJD must not be blood or organ transplant donors or sources of human tissue for preparation of biological products to be used in humans, such as dura mater, pituitary hormones, and human interferon [6, 14].

General Precautions

It is clear that we are dealing with a transmissible pathogen. Once symptoms of CJD develop, the disorder is uniformly fatal. Procedures for decontamination of CJD-infected materials and tissues must be defined and implemented. Resistance of the infectious pathogen of CJD to inactivating procedures is well recognized, but a consensus on exactly what constitutes optimal conditions for its inactivation has yet to be reached [7, 8, 25, 26].

Obvious simple precautions include: specimens submitted to clinical chemistry, surgical pathology, or neuropathology laboratories should be clearly marked as coming from a patient with definite or suspected CJD. Disposable gloves should be worn and any skin contact with possibly infectious materials should be followed by washing with 1N sodium hydroxide for several minutes; the wash water should be sterilized as described below [8, 14]. The pathologist, neuropathologist, and autopsy diener should wear a gown and gloves when handling potentially infectious tissue. The work areas should be restricted to necessary personnel. A manual saw is preferred for opening the skull, and every effort should be made for the saw not to cut into brain or spinal cord tissue; if an electric saw is used, a towel should be placed over the saw blade to reduce the incidence and risk of aerosolization [11]. The autopsy table drain should be plugged and the water collected and decontaminated. The body should be washed with 1N sodium hydroxide, the wash water sterilized, and appropriate precautions communicated to the mortician [14]. Organs and trimmed tissues used to prepare tissue blocks should be meticulously collected and completely incinerated.

Specific Decontamination

The preferred methods of disinfection of CJD-contaminated materials are (1) steam autoclaving at 132°C for one hour; or (2) immersion in 1N sodium hydroxide at room temperature for one hour (see Table). Shorter treatment periods have occasionally not fully inactivated the pathogen [27], and lower dilutions of sodium hydroxide, or even the use of undiluted bleach, are not reproducibly effective [8]. Even more vigorous treatment has been required to sterilize the much higher pathogen titers present in scrapie-contaminated materials [26]. These procedures must be followed on the ward for venipuncture needles, forceps, scissors, and lumbar puncture needles; also for autopsy instruments, autopsy table water, specimen containers and their solutions, centrifuge tubes, the gown, mask, and gloves worn by pathology and hospital staff personnel handling CJD tissues, and unless formalin-fixed tissue blocks are autoclaved before processing, microtome blades, small microtomes, and other pathology instruments [2, 10, 13, 22, 30].

Sterilization Procedures for Creutzfeldt-Jakob Disease Tissues and Contaminated Materials

Fully Effective (Recommended) Procedures
Steam autoclaving for 1 hour at 132°C
Immersion in 1N sodium hydroxide for 1 hour at room temperature
Partially Effective Procedures
Steam autoclaving at either 121°C or 132°C for 15 to 30 minutes
Immersion in 1N sodium hydroxide for 15 minutes, or lower concentrations (less than 0.5N) for 1 hour
Immersion in bleach (undiluted, or up to 1:10 dilution) for 1 hour
Ineffective Procedures
Boiling, ultraviolet irradiation, ethylene oxide sterilization, ethanol, formalin, beta-propiolactone, detergents, quaternary ammonium compounds, Lysol, alcoholic iodine, acetone, potassium permanganate

These procedures will sterilize CJD-contaminated tissue and materials, and there is thus no scientific basis to avoid (for purposes of safety) the performance of a brain biopsy or an autopsy on demented patients. Frequently these biopsies are necessary to establish the proper diagnosis and provide supportive therapy [1, 5]. Future progress in understanding the pathogenesis and molecular biology of this complex disorder depends on obtaining tissue. We hope the procedures outlined in this paper will make it possible to conduct research in a safe and prudent manner.

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Health Care Issues in Neurology

In this issue of the *Annals,* a position paper delineates precautions for Creutzfeldt-Jakob disease. The manuscript was developed under the auspices of the Health Care Issues Committee of the American Neurological Association (ANA). The Committee was appointed in 1984 by Dr James F. Toole, then President of the ANA, with Dr Peter J. Dyck as chairman and Drs Jerome B. Posner, Roger N. Rosenberg, and Joseph J. Volpe as standing members. According to its charge, the committee selects a health care issue of importance to neurologists and forms an ad hoc committee composed of experts in the field in question plus members of the standing committee; their task is to produce a consensus position on the topic. The first of what we hope will be a long and authoritative series appears here. Comments of the readership are invited both on this paper and on possible topics for the future.

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Editor